Measures of Disease Frequency I

Seattle Epidemiology and Biostatistics Summer Session
June, 2004

Prevalence and incidence

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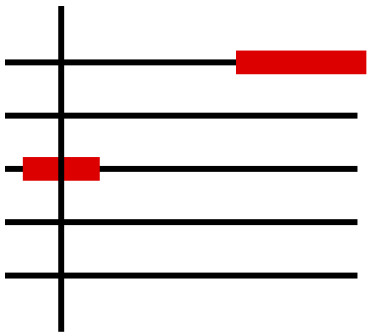
- A static measure: time is “frozen”
- Can be applied to any of several time scales:
  - Calendar time
  - Age
  - Time relative to some salient event

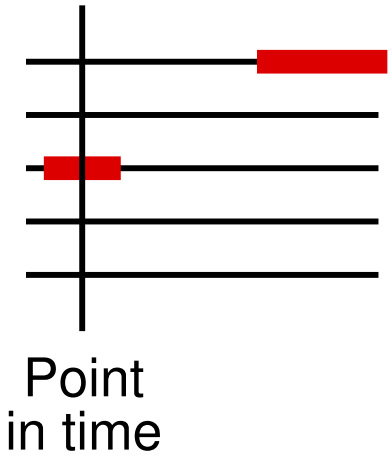
Prevalence diagram

Prevalence diagram



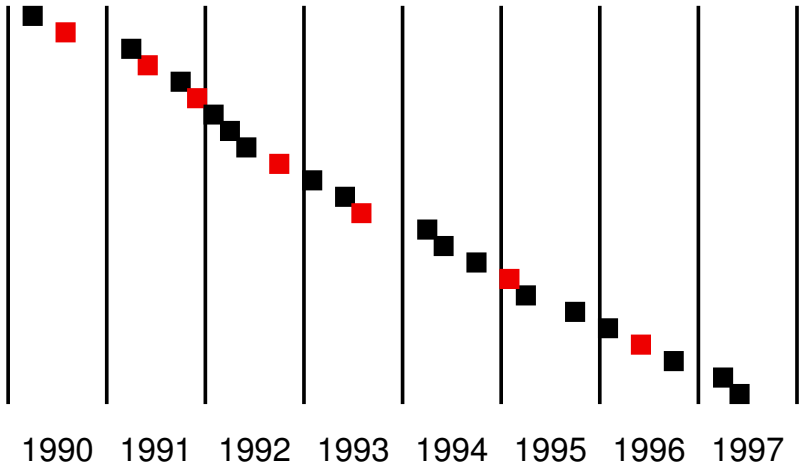
Point
in time

Prevalence diagram



Prevalence = 1/5 = 0.2 = 20%

Chlamydia case detection over time



Newly recognized cases of infection were detected over the time period 1990–1997. So why isn't this *incidence* rather than *prevalence*?

Each person is *not monitored over time*

Time of screening

Common bile duct injury in cholecystectomy

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IOC used?	Cumulative incidence
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- Otherwise, generally use either:
  - *Cumulative incidence*
  - *Incidence rate*

Cumulative incidence

- $$\frac{\text{No. of incident cases}}{\text{No. of people initially at risk}}$$

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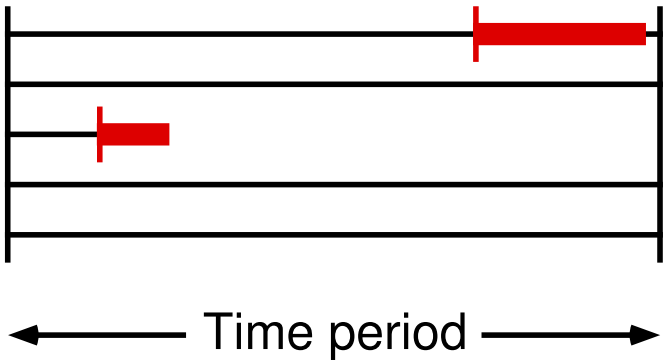
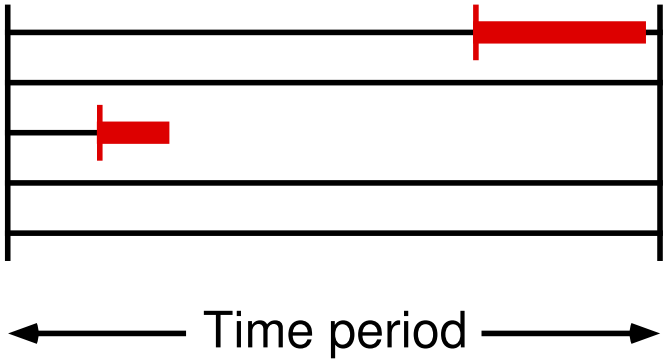
- Also called *attack rate* or *incidence proportion*

Cumulative incidence diagram



Cumulative incidence diagram



Cumulative incidence = 2/5 = 0.4 = 40%

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- Also called *incidence density* or *person-time incidence rate*

If detailed data available on each person

- Calculate each individual's contribution to numerator and denominator
  - Numerator: add up all qualifying disease events
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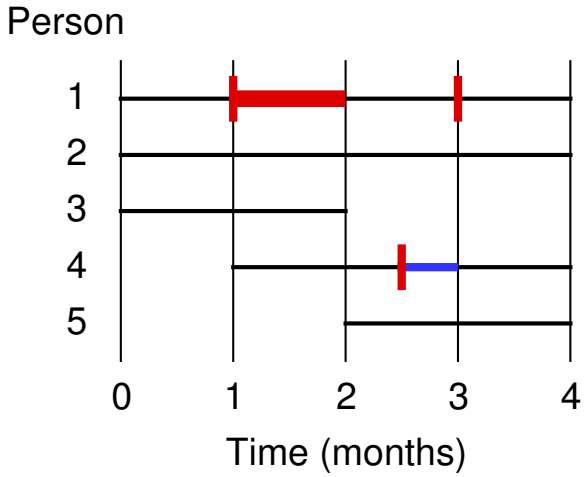
- Example: 15 needle-stick injuries in 1,500 nurse working hours = 1 case per 100 person-hours
- Calculations may differ depending on whether recurrent events in same person qualify

If recurrent events *do* qualify. . .



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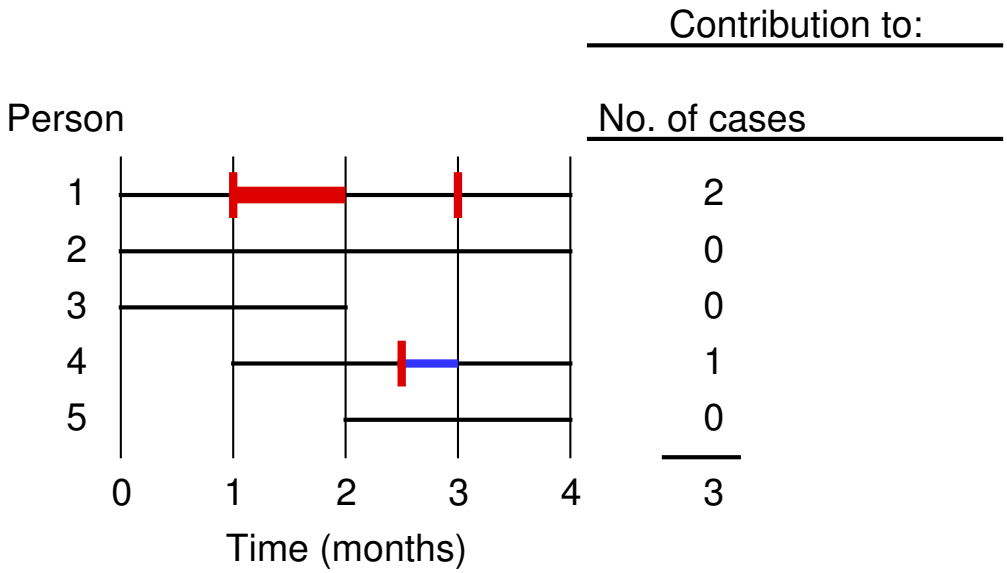

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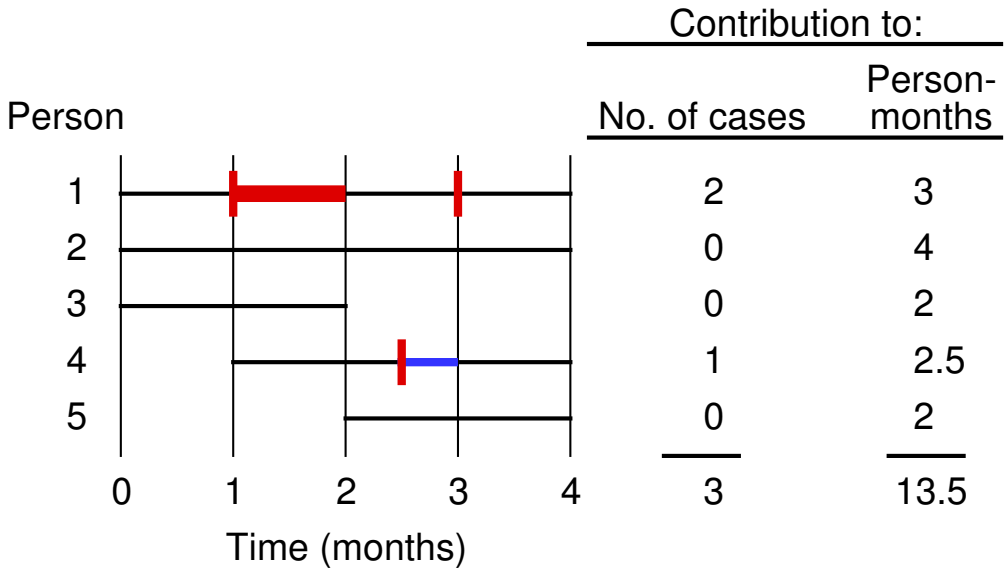
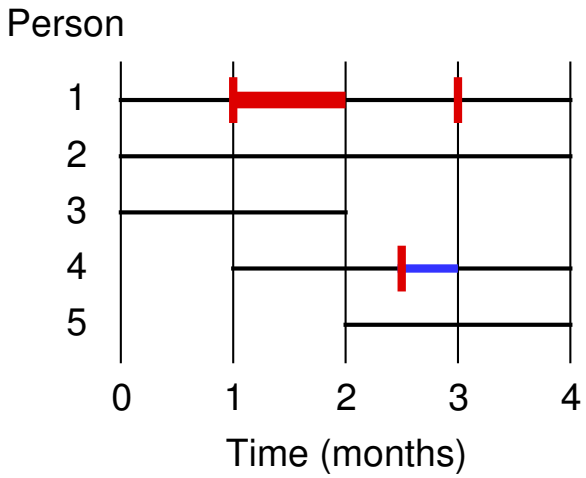


If only *first* events qualify…



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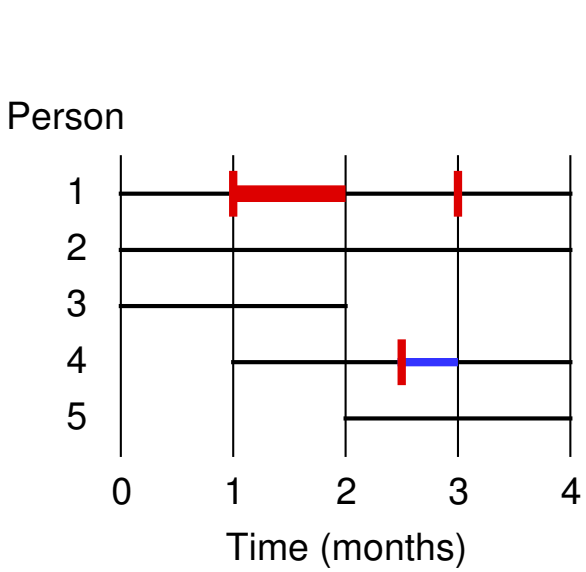

	Contribution to:
	No. of cases
1	1
2	0
3	0
4	1
5	0
	2

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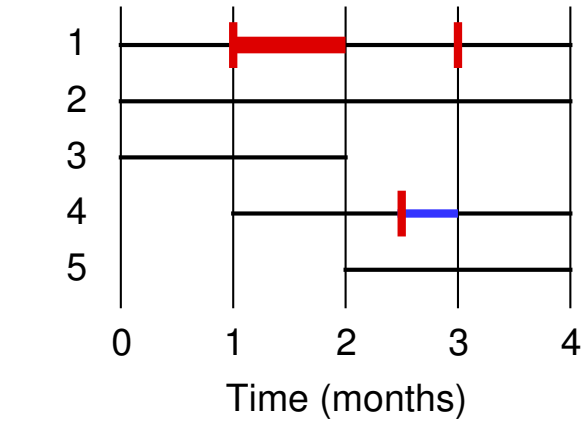

Person	Contribution to: No. of cases	Contribution to: Person-months
1	1	1
2	0	4
3	0	2
4	1	1.5
5	0	2
	2	10.5

If detailed data *not* available on each person

$$\frac{\text{No. of incident cases}}{\left(\begin{array}{c}\text{Avg. size of}\\ \text{population at risk}\end{array}\right)\times\left(\begin{array}{c}\text{Duration of}\\ \text{observation period}\end{array}\right)}$$

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Example: 100 heart attack cases occur in 1 year in a city of 100,000 persons

$$\begin{aligned}\text{Incidence rate} &\approx \frac{\text{100 cases}}{\text{100,000 persons} \times \text{1 year}} \\ &\approx \text{1.0 cases per 1000 person-years}\end{aligned}$$

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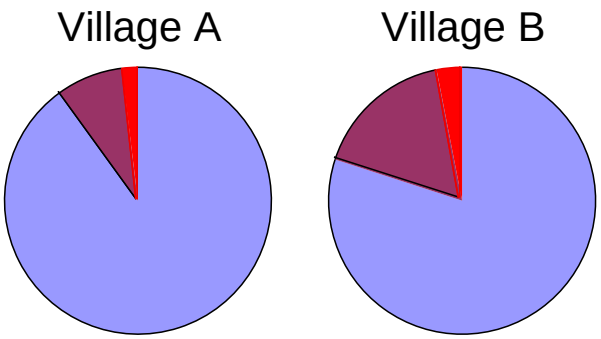
  - Comparing frequency of death from a certain disease across 2+ populations of unknown size

Pitfall of proportional mortality—1



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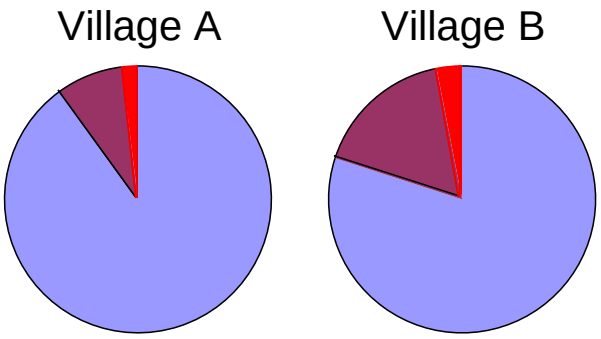

Deaths:		
Disease X	20	30
Other causes	80	170

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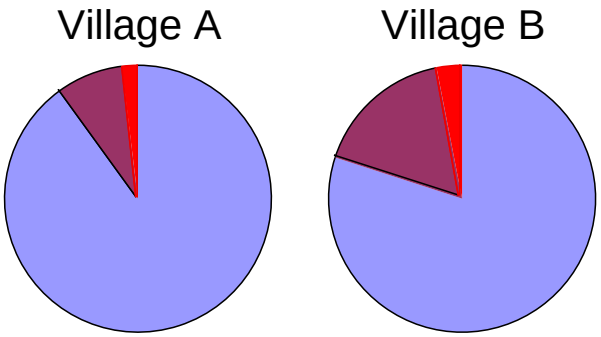

Deaths:		
Disease X	20	30
Other causes	80	170
Survivors:	900	800

Pitfall of proportional mortality—2

	Deaths in 1 year		Propor-tional
Village	Total	Disease X	mortality
A	100	20	20%
B	200	30	15%

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Village	Deaths in 1 year: Total	Deaths in 1 year: Disease X	Proportional mortality	Pop. size
A	100	20	20%	1,000
B	200	30	15%	1,000

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Village	Deaths in 1 year: Total	Deaths in 1 year: Disease X	Proportional mortality	Pop. size	Mortality rate*
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*Deaths per 1,000 person-years

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- Proportional mortality greater in Village A
- True mortality rate greater in Village B (!)

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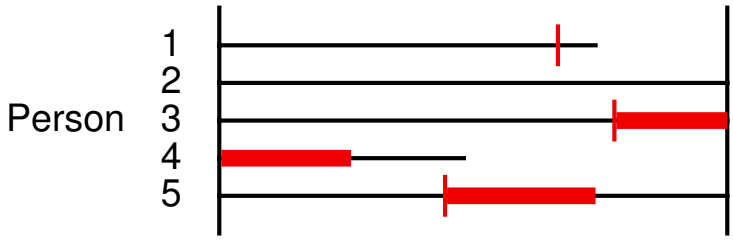

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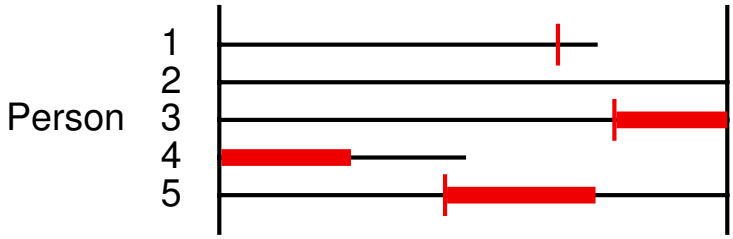

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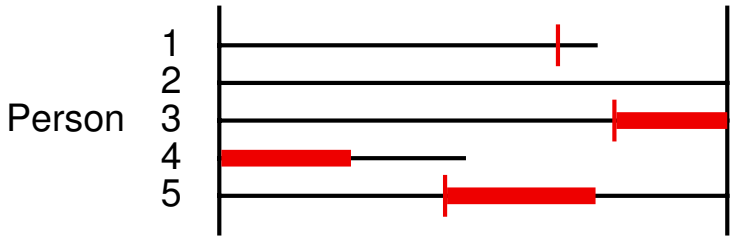

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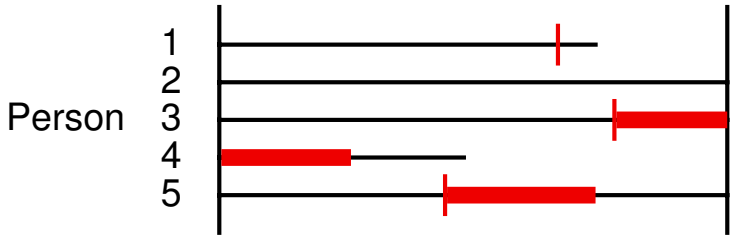

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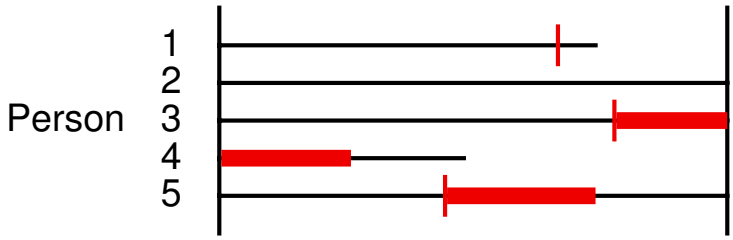

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- Example: period prevalence of diabetes in pregnant mothers is about 25.3 per 1,000

Introduction to Epidemiologic Methods — Summer, 2004
Discussion Questions: Measures of Disease Frequency—1

1. Between January, 1990 and March, 2002, the Food and Drug Administration received 3,339 reports of rhabdomyolysis, a rare disease that involves massive breakdown of skeletal muscle cells, among users of a class of drugs called statins, which reduce blood cholesterol. Some 1,899 of the rhabdomyolysis cases had taken a particular drug, cerivastatin. During that time period, cerivastatin accounted for about 2.0% of all statin prescriptions.

   Assume for present purposes that the number of days' worth of medication dispensed with each prescription was about the same for all statins and that the reporting of rhabdomyolysis was complete. From the data given, can you estimate the ratio of the incidence of rhabdomyolysis among cerivastatin users to the incidence of rhabdomyolysis among users of other statins? If so, what is it? If not, why not?

2. Hepatitis C is of concern to the Department of Veterans Affairs (VA) because many VA users are thought to fall into groups at high risk for this disease. It is believed to cause cirrhosis, liver cancer, and other complications. Among the early studies that have sought to gauge the extent of infection among VA users were:

   - In early 1994, 839 consecutive patients admitted to the Washington, D.C. VA Medical center were tested, and 173 (20.6%) of them were found to be infected with hepatitis C.
   - On March 17, 1999, some 26,000 outpatients at VA clinics nationwide who agreed to be tested were screened for hepatitis C. The exact number of positives is not available, but the prevalence was reported to be 8–10%

   What main concern(s) would you have about using these results as estimates of the prevalence of infection among veterans? Would you expect the estimates to be biased upward or downward?